OBESITY PROTECTION OF GUINEA PIGS WITH PROTEIN HYDROLYSATE HYDROPROT

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The increased food consumption, especially fats and carbohydrates combined with non-corresponding energy exhaust is the most common pathogenetic factor for obesity (4). Taking saturated fatty acids with food causes a considerable increase of the amount of serum lipids (8, 14, 15) and cholesterol mean level shows a linear dependence on the energy supplied by saturated fatty acids. Both butter and lard contains the largest amount of saturated fatty acids among fats most commonly used in human nutrition (14). It is well known that giving a rich protein diet together with lipids inhibits serum cholesterol and other lipids increase (6, 16). There are favourable results from protein hydrolysate application in cholesterol fed animals (1).

The aim of the present investigation is the experimental obesity reproduction in guinea pigs fed a rich in lard diet and the checking up of the protein hydrolysate Hydroprot influence on the development of this pathological state.

Material and methods

The experimets were carried out on 25 male guinea pigs at the same age with 330—430 g. b. w. divided into three groups. The animals of the Ist and IInd group were given lard (4 g daily to each one) added to the common laboratory food (pressed into briquettes fodder mixtures) while these of the IIIrd group (controls) were fed laboratory food only. Each animal was given a total of 20 g food daily. Protein hydrolysate (1,3 ml/100 g b. w.) was added to the food of the animals of the IInd group. The animals were fed in this manner 100 days long.

We determined the body weight of the animals, serum lipid and total protein levels as well as the weight of liver, thymus, and adrenals. Test reagents of the firm Boeringer (GFR) were used for cholesterol and total lipids estimation. Betalipoproteins were determined after Burstein et Samaille's method (modification of Ledvina-3) and total protein levels — after D. H. Lowry's et. al.(12) method. The data of the absolute organs' weight were calculated in per cent towards the body weight. The results obtained were statistically processed by means of variational analysis.

Results and discussion

The body weight shows the most considerable increase in the animals of the Ist group — with 189 g as compared with the initial rate while the animals of the IInd group gain least weight — 121,5 g that is reliably less as compared with the animals of the Ist group ($p=0,05$). At the same time the controls gain weight

with 173 g (see table 1). The animals of the first group demonstrate also an increase of serum lipids and cholesterol nearly twice and of beta-lipoproteins about 2,5 times in comparison with the controls. Total lipids increase from 3,62 g/l (for the

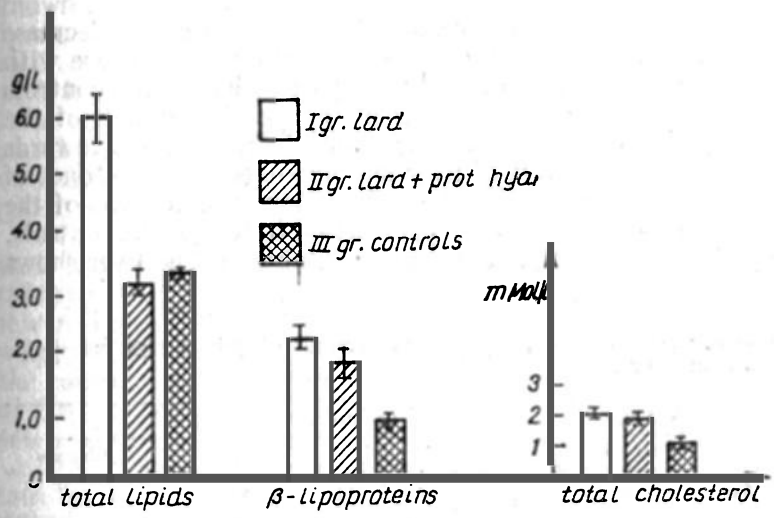

Fig. 1. Changes of serum lipids (total lipids, total cholesterol and beta-lipoproteins)

controls) up to 6,34 g/l (for lard fed animals); resp. cholesterol from 1,37 mmol/l up to 2,76 mmol/l ($p < 0{,}001$) and beta-lipoproteins from 0,95 g/l up to 2,39 g/l ($p < 0{,}001$) (see fig. 1).

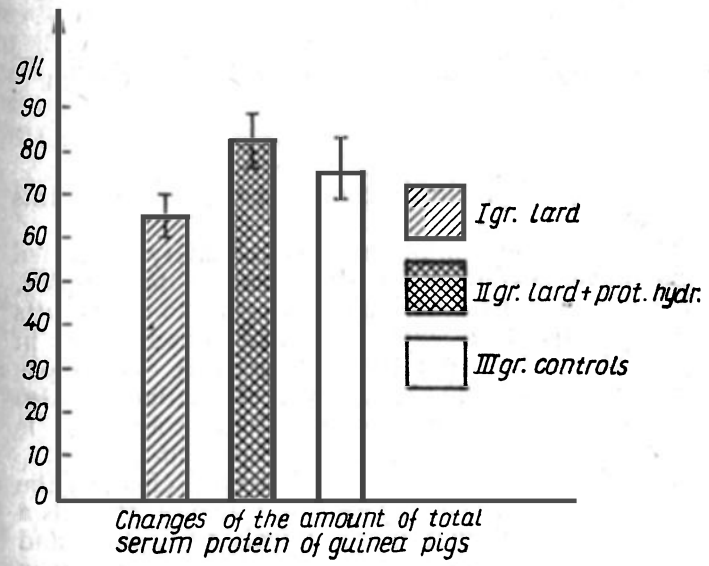

Fig. 2. Changes of the amount of total serum protein

We did not establish any significant changes of total lipids level of the guinea pigs of the II[nd] group as compared with those of the controls ($p > 0,05$). Cholesterol and beta-lipoprotein levels increase less considerably than these of the animals of the I[st] group while in comparison with these of the controls this increase is significant ($p < 0,01$) (fig. 1).

The changes of serum proteins present certain interest. There is a decrease with 11,3 per cent in the animals of the I[st] group ($p > 0,05$) but an increase with 9,8 per cent in these of the second group as compared with that of the controls ($p > 0,05$) and it is statistically reliably higher than that of the animals of the I[st] group ($p < 0,05$). Concerning the rates of body weight of single organs towards total body weight there are higher levels of liver and adrenals but lower ones of thymus in the animals of the I[st] group. Liver weight is lower in animals of the II[nd] group while thymus one does not change in comparison to that of the controls. Adrenals' weight is higher than that of the controls (see table 1). The liver shows

Table 1

Body weight and relative weight of liver, thymus and adrenals of guinea pigs fed with lard and protein hydrolysate

Group	Number	Body weight (g)		Relative weight (g %)		
		Before	After Experiments	Liver	Thymus	Adrenals
		$\bar{x}$ $S\bar{x}$	$\bar{x}$ $S\bar{x}$	$\bar{x}$ $S\bar{x}$	$\bar{x}$ $S\bar{x}$	$\bar{x}$ $S\bar{x}$
I[st] group (lard)	8	359±11,00	548±18,85 $P_1:P_2=0,05$	4,07±0,28	0,050±0,008	0,057±0,005
$P_1:P_3$		>0,05	>0,05	>0,05	>0,05	>0,05
II[nd] group (lard+ prot. hydr.) $P_2:P_3$	10	379±11.2 0,05	500,5±15,78 0,05	3,75±0,14 0,05	0,060±0,005 0,05	0,055±0,01 0,05
III[rd] group (controls)	5	365±40,04	538±13,93	3,93±0,24	0,061±0,008	0,045±0,001

a less expressed to absent macroscopic lipid infiltration as compared with this of the animals of the I[st] group.

Our results show that lard rich diet containing predominately saturated fatty acids causes body weight increase combined with increase of total lipids, total cholesterol, and betalipoproteins. These data are analogous to the results of some authors (8, 9, 14) and correspond to everyday practice observations in obesity patients. It is accepted that saturated fatty acids activate endogenous cholesterol synthesis. Besides lipid metabolism changes this diet influences also protein metabolism resulting in serum total protein reduction. Probably it is due to a disturbance of liver protein production caused by lipid infiltration.

The addition of protein hydrolysate to the food has a protective effect on the process of obesity. The total lipid level does not increase, in contrary, there is a tendency towards decrease as compared with that of the controls. Cholesterol and beta-lipoprotein increase is reliably less expressed. These results are in accordance with some authors' data (1, 2) concerning the hydrolipaemic effect of protein hy-

drolysate in experimental atherosclerosis and in normally fed guinea pigs and broilers.

The less expressed liver lipid infiltration with the animals of the IInd group could be explained with the lipotropic effect of the hydrolysate applied. It is known that methionine and cystine both possess such an effect, too (7). The hydrolysate is rich in sulfur-containing as well as in any other amino acids. According to D. J. Lee et al. (11) dietary protein contents is in an opposite correlation with liver lipids percentage. The proteins suppress fatty acid synthesis in the liver (17) and activate the turnover of saturated fatty acids into unsaturated ones by stimulation of hepatic ribosomal 6-desaturase (13). This is the probable mechanism by which protein hydrolysate protects the liver against lipid degeneration in diet rich in fats.

The supply of rich plastic material (amino acids of the hydrolysate) and their lipotrophic influence upon the liver contributes to the increase of serum protein synthesis. The favourable effect of protein hydrolysate on both lipid and protein metabolism as well as on the liver is confirmed by the data about the body weight, too. The less expressed weight gain (with 29,8 per cent as compared with the control rates and with 39,05 per cent as compared with these of the animals of the Ist group) is most probably due to the hypolipaemic influence of hydrolysate and to the stronger specific-dynamic action of its amino acids.

The data about organs' weight show that by the influence of fatty diet a certain thymus atrophy and adrenals' hypertrophy sets in. The application of protein hydrolysate protects the thymus against atrophy without effecting significantly adrenals' weight. These results are analogous to the changes of both thymus and adrenals in cholesterol fed animals (5). It is probably due to the development of a hypercholesterolaemia while thymus is maintained rather well because of protein hydrolysate amino acids supply.

It can be concluded that lard enrichment of the normal diet of guinea pigs causes an obesity resulting in serious changes of serum lipids and total protein levels, of body weight and of the weight of liver, thymus and adrenals as well as in liver adipose degeneration. The application of protein hydrolysate Hydroprot at dose of 1,3 ml/100 g b. w. improves the indexes studied and brings them nearer to these of the control animals. It supports I. Popdimitrov's concept that the changes of lipid metabolism correlate with these of protein one.

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ПРЕДУПРЕЖДЕНИЕ ОЖИРЕНИЯ МОРСКИХ СВИНОК, ПРИНИМАЮЩИХ БЕЛКОВЫЙ ГИДРОЛИЗАТ ГИДРОПРОТ

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РЕЗЮМЕ

Проведены опыты на 25 мужских морских свинках. Животные были разделены на три группы. Первая группа животных принимала с пищей свиное сало по 4 г в день в течение 100 дней. Вторая группа принимала такую же пищу с прибавлением белкового гидролизата по 1,3 мл/100 г веса тела. Третья группа животных (контрольная) принимала обычную пищу.

Установлено чувствительное увеличение веса тела и количества сывороточных липидов (общих липидов, бета-липопротеинов и общего холестирола) у животных первой группы, а также тенденция к уменьшению белка в сыворотке. У морских свинок, принимающих белковый гидролизат вес увеличивается меньше, но устанавливаются изменения в количестве общих липидов; увеличивание бета-липопротеинов и холестирола меньше, а количество белков больше.